

led to inflict upon you, the central idea concerning the proposed action of this Society I hope begins to loom with a more or less definite form. It is not for you to add to the general tinkling of small bells, but it remains for you to bring together a strong staff of expert ringers who can give us a good loud peal on the chimes. You will, I hope, sooner or later, set an example in technical education in your own subject—which so admirably lends itself to the purpose—which shall act indirectly on all related subjects, by showing how much of the real work of technology begins after the elementary and advanced training have been completed. The instruction imparted under the existing arrangements is good as far as it goes, but from your point of view it must be regarded as the means of supplying the raw materials out of which the technologist of the future is to be moulded. It is not your province to assist in the multiplication of elementary classes, but to set the seal of efficiency on the existing organizations.

I should have but little justification for addressing you as I have did I not feel what a splendid opportunity lies before you for raising the level of at least one important branch of technology. Still less should I be justified in responding to your invitation did I not offer some suggestions which may be of use in furthering your object. The Photographic Institute, such as we desire, would be an establishment thoroughly equipped for the best practical instruction, well provided with appliances for carrying on research in every department of the subject, and having attached to it the most competent specialists in every branch. The staff need not be numerous at first; a chemist, an optician and physicist, an expert in photo-mechanical processes, and an artist would represent the chief departments. Your committee or governing body would know the right men to select; if they cannot be found in this country you may have to go abroad for them. This course may appear ignominious, but if it has to be adopted so much the better; it will bear practical witness to the necessity of having the means of raising such men in our own country. The ideal institute may be a slow growth, but every effort should be made to establish it. The Photographic Society has already taken the initiative by proposing an affiliation with kindred Societies. This scheme should be energetically pushed forward, and every means adopted for urging the importance of the claims of photography to have a recognized technological centre. I venture to think that an impetus would be given to the movement if representatives of the Camera Club, the Photographic Convention of the United Kingdom, and of the numerous photographic Societies of the metropolis were invited to another conference, such as was held last year, but with the special object of forming a joint committee, under whose authority a further appeal might be made for public and private support. If only a moderate fund could be raised at first, operations might be commenced. Surely the numerous firms which have come into existence through the general introduction of photographic processes, and the large body of wealthy amateurs who practice the art as a pastime, might be sufficiently interested in the movement to give it their support.

It only remains now to bring these suggestions to a practical issue. We are such a very practical nation that unless something tangible is offered, the foundation of the Institute may be indefinitely delayed; as yet there is nothing of the kind in existence—there is no organized work being done that appeals directly to the patriotism and to the pockets of those to whom you may legitimately look for assistance. But elementary photography is being taught in connection with technical schools and classes all over the country. A good beginning might be made if under the auspices of the joint committee a few first-class specialists were enlisted and authorized to give short courses of demonstrations to those affiliated Societies or in those centres which desired to receive such instruction. The local centres might fairly be asked to make the necessary arrangements and to bear the small expense of local organization; the fund raised by the joint committee would be well spent at first in defraying the costs of a few special lectures. You may have some difficulty in laying your hands on the right men for this work; I need hardly remind you that the whole success of this initial movement would depend upon your sending only the most highly qualified specialists. You must have men who can teach the teachers and convince practical photographers that underlying the practice of their art are broad scientific principles which it is their interest to know something about. These preliminary peripatetic courses must be regarded in the light of missionary efforts, having for their object not the multiplication of photographic operators, but the awakening of the elementary

and advanced student to the higher aspects of their subject. It is desirable to have this function of the lectures well understood at the outset; the experts who are entrusted with this work will know well enough that it is impossible to make a technologist out of a student, however enthusiastic he may be in his subject, simply by giving him a course of lectures.

If the system of itinerant instruction which I have suggested can only be fairly started, even on a small scale, one important function of the Institute will have been inaugurated. It will have a claim upon the practical educationalist as a teaching body; it will appeal more specifically to the promoters of technical education and to those public bodies which have voluntarily or by Act of Parliament identified themselves with this movement. It is certainly discouraging—I may say discreditable—when we see the magnificent scale on which the photo-technical Institutes of Berlin and Vienna have been founded and equipped, that in this country, whatever the importance of the subject, public recognition and support come only after success has been achieved by private enterprise. I am afraid you will have to reckon with this national characteristic, which, although retarding advancement in many directions, is so far good that it calls forth the most strenuous exertions to insure success at the outset of every new movement. Upon the success of your first small undertaking will depend the larger ultimate success which we all look for.

One other suggestion occurs to me which may help to strengthen your hands. I have said that instruction in photography is already being given in many technical schools; this instruction is more or less of an elementary character. It seems feasible to combine with the proposed courses of special lectures a system of inspectorship which might be carried out by the same staff. Your lecturers would be recognized experts, capable of advising such schools as to methods of teaching and of co-operating with local centres in the selection of the most highly qualified teachers. I am sure that most centres would be only too glad to avail themselves of the knowledge and experience thus placed at their service. If you begin operations on these lines at first—if you can carry on this combined system of skilled teaching and inspection successfully for a few years, your claim for permanent establishment and endowment as a Photographic Institute cannot but receive that support from public bodies to which your educational efforts will have entitled you, and which in other countries is given by the State.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—*Commencement of Hilary Term.*—The usual notices are being issued this week to undergraduates to come into residence the end of next week, full term commencing February 8. The notices state that Hilary Term will be of the usual length—eight weeks. Residence for Easter Term will begin on April 22. The dates for the examinations in Hilary Term have been fixed as follows: Preliminary in Natural Science, March 14; First Public Examination for Honours in Classics, March 17; Responsions, March 31.

It has been stated that this is the first time the date of the commencement of Term has been postponed by reason of an epidemic since the date of the Great Plague in the seventeenth century, when a whole term was abandoned.

The Senior Mathematical Scholarship has been awarded to Mr. A. E. Jolliffe, B.A., late Scholar of Balliol and Fellow of Corpus Christi; Proxime Accessit, Mr. R. C. Fowler, B.A., of New College, to whom the examiners have awarded Lady Herschel's Prize for Astronomy. Mr. H. H. Piggott, Corpus Christi, was awarded the Junior Mathematical Scholarship; and to Mr. H. A. Pritchard, of New College, the Junior Mathematical Exhibition.

CAMBRIDGE.—Mr. F. W. Dyson, B.A., of Trinity College, bracketed Second Wrangler, 1889, and Smith's Prizeman, 1891, has been elected to the second Isaac Newton Studentship, tenable from April 15, 1892, to April 15, 1895.

Mr. J. H. Flather, late Master of Cavendish College, has been appointed Assistant-Secretary for the Local Examinations.

An Exhibition of fifty guineas a year is offered by the Clothworkers' Company for proficiency in physical science. It is tenable for three years by a non-collegiate student of Oxford or Cambridge. Application is to be made to the Censor, Fitzwilliam Hall.

An influential syndicate has been appointed to obtain plans

and estimates for the erection of the Sedgwick Memorial Museum of Geology on a site within the Old Botanic area, contiguous to the new Chemical Laboratory.

Dr. Forsyth, F.R.S., is appointed an additional member of the Mathematical Board for one year.

In consequence of the lamented death of Sir George E. Paget, Sir G. M. Humphry and Dr. D. MacAlister have been appointed to act for the Regius Professor of Physic, in reference to Acts for medical degrees during the vacancy in the professorship.

SOCIETIES AND ACADEMIES.

LONDON.

Mathematical Society, January 14.—Prof. Greenhill, F.R.S., President, in the chair.—The President drew the attention of the members present to the loss the Society had sustained by the recent death of Prof. Kronecker, who was elected an honorary member on January 14, 1875.—The following communications were made:—The harmonic functions for the elliptic cone, by E. W. Hobson. The harmonic functions for the circular cone were introduced by Mehler; an account of them is given in Heine's *Kugelfunctionen*. In this communication the more general functions are considered, which are required for potential problems connected with the elliptic cone. It is shown that the normal functions are of the form

$$\frac{1}{\sqrt{r}} \sin(\rho \log r) \cdot A(\mu) B(\nu),$$

where r is the radius-vector, and μ, ν are elliptic co-ordinates, the functions A, B satisfying differential equations which differ from Lamé's equation only in having $-\frac{1}{2} + \rho\sqrt{-1}$ instead of n ; thus the functions A and B are Lamé's functions of complex degree. The forms of these functions as required for the potential problem are considered, and some examples of their application are given.—Some theorems relating to a system of coaxial circles, by R. Lachlan. This paper is based on a suggestion contained in a short note by Dr. A. S. Hart in the *Quarterly Journal* (vol. ii. p. 143), who indicated a simple and elementary method of obtaining Poncelet's theorem. In the present paper this method is discussed in detail. Poncelet's theorem may be thus stated: *If $A_1, A_2, A_3, A_4, \dots, A_n$, be n points taken in order on the circumference of a circle S , so that any $(n-1)$ particular connectors of the polystigm $A_1A_2 \dots A_n$ touch fixed circles coaxial with S , then the remaining connectors of the figure will envelop circles which belong to the same coaxial system.* If now S_p, q denote the circle which is touched by the chord A_pA_q , it is proved that if $(n-1)$ connectors of the polystigm touch any $(n-1)$ of the circles $S_1, 2, S_1, 3, \dots, S_{n-1, n}$, the remaining connectors of the polystigm will envelop the remaining circles. A few special cases are then discussed, among which the most interesting is the case of $2n$ points $A_1, A_2, \dots, A_{2n}$, taken in order on a circle S , so that the chords $A_1A_2, A_2A_3, \dots, A_{2n}A_1$ touch another circle S' : it is then proved that the n chords $A_1A_{n+1}, A_2A_{n+2}, \dots, A_nA_{2n}$, must intersect in a limiting point of the circles S and S' , and that the remaining $2n(n-2)$ connectors may be divided into $(n-2)$ sets of $2n$, each set being tangents to a circle coaxial with S and S' . Further, it is proved that the $2n(n-1)$ connectors which do not intersect in the limiting point may be arranged in $n(n-1)$ pairs, each pair touching two circles of the system.—Note on the formula for the number of classes of binary quadratic forms of a given determinant, by Prof. G. B. Mathews.—Researches in the calculus of variations (third paper), by E. P. Culverwell.—Mr. E. B. Elliott, F.R.S., made a short oral communication on a generalization of De Morgan's method of duality in partial differential equations. He exhibited schemes of linear substitution for one set of variables in terms of another set of first derivatives, which have the self-dual property, discussing the cases of two and of three independent variables.—Major MacMahon, F.R.S., mentioned the "stamp-folding" problem, at which Prof. Schoute, of Groningen, has been working. For a strip of stamps (one stamp width), the following results, when the strip is folded so that the face (or back) of one stamp only is exposed, were given: (1) = 1, (2) = 2, (3) = 6, (4) = 16, (5) = 50, (6) = 144, (7) = 462, (8) = 1398 (?), (9) = 4527. For squares, the results given were (2) = 8, (3) = 296, (4) = 13007 (?). (9) is found to give more than $2\frac{1}{2}$ billions. The law of formation of the numbers is sought.—Messrs. Basset, Love, Kempe, Hobson, Prince C. de Polignac, and the President spoke upon the papers.

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Linnean Society, January 21.—Prof. Stewart, President, in the chair.—On a motion by the President, it was unanimously resolved that an expression of respectful sympathy should be conveyed to Her Majesty the Queen, and to H.R.H. the Prince of Wales, on the loss sustained by the death of H.R.H. the late Duke of Clarence and Avondale.—Mr. M. F. Woodward exhibited microscopic sections illustrating the development of the teeth in the Marsupialia. He drew attention to Prof. Kükenthal's recent discovery of supposed rudimentary successors in all the teeth, thus showing that the adult set of teeth must be regarded as belonging to the first or milk series, and not, as generally supposed, to the second or successional dentition. These statements he was able to confirm for the incisors and second upper molar of *Didelphys*. In the *Phalanger* (*Trichosaurus*) he found no trace of these structures in connection with the molar teeth, but they were present with the upper incisors. In no case did these rudimentary successional teeth pass beyond the condition of simple downgrowths from the enamel organs of the functional teeth.—Mr. J. W. Willis Bund exhibited a supposed hybrid between the common and red-legged partridges, but in the opinion of ornithologists present it was regarded as merely a variety of the former species.—Mr. J. C. Mansel Pleydell exhibited a pair of malformed horns of the roebuck found at Whatcombe, Blandford, Dorset, their peculiar growth resulting from exostosis consequent upon injuries sustained while in the sensitive condition.—Mr. D. Morris communicated some further notes upon the tick-pest of Jamaica, upon which an animated discussion took place.—A paper was then read by Mr. F. E. Weiss "on the development of the caoutchouc-containing cells of *Eucommia ulmoides*, Oliver." He found that the bark and leaves of this tree, used medicinally by the Chinese, and called by them "Tuchung," contain numerous elastic threads of silky appearance, which proved to be of the nature of caoutchouc. They are contained in long, unbranching cells, somewhat like latex cells, which are found in the cortex and in the secondary phloem, and accompany in large numbers the ramifying bundles of the leaf and the pericarp. Unlike the ordinary latex cells, they are not derived from specialised cells of the embryo, but originate in all new growths, and can be seen forming in the cortex, the pith, and the parenchyma surrounding the bundle of the petiole. They originate in twos, by longitudinal division of a very granular cell, both daughter cells growing out at their two extremities into a long tube, which makes its way along the intercellular spaces by sliding growth. They never contain more than one nucleus, and the large granules of caoutchouc, which soon make their appearance, finally coalesce into a single solid mass, which has, when the tissues are broken, the appearance of a silky thread. Mr. Weiss regards these cells as a primitive form of latex cells, similar to those from which the more elaborate ones of the ordinary *Euphorbiaceæ* may have been derived.—The meeting was brought to a close with a paper by Dr. Jean Müller on the Lichens of Manipur.

Royal Meteorological Society, January 27.—Annual General Meeting.—Dr. W. Marcet, F.R.S., Vice-President, in the chair.—The Report of the Council for the past year showed the Society to be in a very satisfactory position. In May the library and offices were removed to more commodious premises at 22 Great George Street. After defraying the cost of fitting up the new offices, and the increased rental, there still remained a balance in hand of £224. Thirty-four new Fellows were elected during the year, the total number on the roll of the Society now being 552. Owing to the absence of the President, Mr. Baldwin Latham, through an attack of influenza, his address on "Evaporation and Condensation" was read by the Secretary. The question of evaporation is of as great importance as the study of the precipitation of water on the face of the earth, as the available water supplies of the country entirely depend upon the differences between these two sets of observations. The earth receives moisture by means of rain, dew, hoar-frost, and by direct condensation. It loses its moisture very rapidly by evaporation. Although evaporation mainly depends upon the difference between the tensional force of vapour due to the temperature of the evaporating surface, and the tensional force of the vapour already in the atmosphere, yet it is largely influenced by the movement of the air and by its dryness, or the difference between the dew point and the actual air temperature. Evaporation goes on at night so long as the water surface is warmer than the dew point. With sea-water the evaporation is about $4\frac{1}{2}$ per cent. less than with rain water, while